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PAUL S MADAN
MADAN, MOSSMAN & SRIRAM, PC
2603 AUGUSTA, SUITE 700
HOUSTON, TX 77057-1130

EXAMINER

HUGHES, SCOTT A

ART UNIT	PAPER NUMBER
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3663

DATE MAILED: 03/11/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/641,356

Applicant(s)

MATHISZIK ET AL.

Examiner

Scott A Hughes

Art Unit

3663

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-28 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-28 is/are rejected.
- 7) ☒ Claim(s) 27 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on ____ is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|--|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date ____ | 6) <input type="checkbox"/> Other: ____ |

DETAILED ACTION

Claim Objections

Claim 27 is objected to because of the following informalities: Claim 27 claims dependence from claim 25, and refers to the limitation "said full waveform processing." This limitation of "said full waveform processing" is not mentioned in claim 25, but is part of claim 26. Therefore, claim 27 should claim dependence from claim 26, not claim 25. For the purposes of this action, claim 27 was examined as if it depended from claim 26. Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-4, 6, 10-16, 18-22, and 24-27 are rejected under 35 U.S.C. 102(b) as being anticipated by Leggett ('294).

With regard to claim 1, Leggett discloses an acoustic logging apparatus. Leggett discloses a bottom hole assembly 59 (Fig. 1) conveyed on a drilling tubular 20 in a borehole within an earth formation (Column 7, Lines 5-15), said BHA comprising a source array for emitting preselected acoustic signals into the earth formation (Column 9, Lines 40-62; Column 15, Lines 36-55). Leggett discloses at least one receiver R (Fig. 7) on the BHA for receiving a second acoustic signal produced by interaction of said

preselected acoustic signals with the formation (Column 13, Line 20 to Column 14, Line 5).

With regard to claim 2, Leggett discloses that the source comprises an azimuthally distributed array of axially directed sources T1, T2 (Figs. 3a,7) (Column 9, Lines 40-62).

With regard to claim 3, Leggett discloses activating the source array according to pre-selected sequential time delays (Column 15, Lines 42-45).

With regard to claim 4, Leggett discloses a source array for emitting the preselected acoustic signals which differs in spectrum or wavemode from the acoustic energy of the rotating drillstring (Column 15, Lines 36-40). Leggett discloses that the transmitters are adapted to transmit signals at a desired frequency level or that they can sweep a range of frequencies. Leggett discloses earlier a need to get rid of background noise (Column 12), and therefore the range and selected frequencies of Leggett would be different in spectrum and wave mode from the acoustic energy of the rotating drill string.

With regard to claim 6, Leggett discloses a receiver located at least two wavelengths from an element of the source array (Column 9, Lines 41-62). Leggett discloses that the far receivers are located 4.5 meters from the source. Since the source is operating at 5-20KHz, and the acoustic velocity is a parameter that is trying to be determined, the distance would necessarily be more than two wavelengths from the source to the receiver.

With regard to claim 10, Leggett discloses that one of the receivers receives the second signal that has traversed part of the formation (Fig. 5) (Column 11, Lines 33-67).

With regard to claim 11, Leggett discloses a method of obtaining information about a parameter of interest of an earth formation. Leggett discloses using a drill bit 50 on a bottom hole assembly conveyed on a drilling tubular for drilling a borehole in the earth formation (Column 4, Lines 49-65) (Fig. 1). Leggett discloses suspending drilling operations and using the drilling tubular to move the drill bit away from the bottom of the borehole (Column 9, Line 63 to Column 10, Line 10). Although Leggett does not specifically disclose moving the drill bit away from the bottom of the borehole, he does disclose that drilling is stopped before the acoustic signals are generated, and in order to stop the drilling, the drill bit would lose contact with the bottom of the borehole. Leggett discloses generating an acoustic signal into the earth formation using an acoustic source array T on the BHA (Fig. 7) (Column 13, Lines 20-54; Column 14, Lines 55-63; Column 9, Line 63 to Column 10, Line 10). Leggett discloses determining a parameter of interest (acoustic velocity, bed boundary information) from a received signal resulting from an interaction of the generated acoustic signal with the earth formation (Column 9, Line 63 to Column 10, Line 10).

With regard to claim 12, Leggett discloses generating an acoustic signal comprising sequentially activating elements of an acoustic source array (Column 9, Lines 63-67; Column 15, Lines 42-44).

With regard to claim 13, Leggett discloses that generating the acoustic signal further comprises activating elements of the acoustic source array in the borehole axial

direction according to a pre-selected sequential time delay (Column 9, Lines 63-67; Column 15, Lines 42-44) (Fig. 7).

With regard to claim 14, Leggett discloses that the received signal has traversed part of the earth formation that is adjacent to the borehole (Fig. 5) (Column 11, Lines 33-67).

With regard to claim 15, Leggett discloses that determining the parameter of interest comprises defining a reflector imaging direction that is parallel to the axis of the borehole, oblique to the axis of the borehole, or perpendicular to the axis of the borehole depending upon the orientation of the reflector (bed boundary) (Figs. 3a, 7) (Column 11, Lines 33-67).

With regard to claim 16, Leggett discloses that the generated acoustic signal is differing in a spectrum of acoustic energy of a rotating drillstring (Column 15, Lines 36-40). Leggett discloses that the transmitters are adapted to transmit signals at a desired frequency level or that they can sweep a range of frequencies. Leggett discloses earlier a need to get rid of background noise (Column 12), and therefore the range and selected frequencies of Leggett would be different in spectrum and wave mode from the acoustic energy of the rotating drill string.

With regard to claim 18, Leggett discloses a system for determining a property of an earth formation using an acoustic logging tool on a bottomhole assembly in a borehole in an earth formation. Leggett discloses at least one source array in an acoustic logging tool for generating preselected acoustic signals into the formation, with the preselected acoustic signals differing in spectrum and/or wave mode from acoustic

energy of a rotating drill string (Column 15, Line 36 to Column 16, Line 22). Leggett discloses that the transmitters are adapted to transmit signals at a desired frequency level or that they can sweep a range of frequencies. Leggett discloses earlier a need to get rid of background noise (Column 12), and therefore the range and selected frequencies of Leggett would be different in spectrum and wave mode from the acoustic energy of the rotating drill string. Leggett discloses a plurality of receivers R on the logging tool for receiving signals indicative of a parameter of interest (Fig. 7). Leggett discloses acquiring signals at a plurality of depths of the BHA (Columns 3-4) Leggett discloses that the measurements are made to geosteering the bit and to update formation models. Therefore, the measurements are necessarily made at a plurality of depths to be able to continue to steer the bit as the drilling progresses and to update the formation model as the borehole depth progresses. Leggett discloses processing the acquired signals to obtain the parameter of interest (Column 4, Lines 1-5)

With regard to claim 19, Leggett discloses that the signals are acquired when the BHA is not in contact with the bottom of the borehole (Column 10, Lines 1-10). Leggett discloses performing the measurements while the drilling is stopped, and therefore the drill bit would not be in contact with the bottom of the borehole.

With regard to claim 20, Leggett discloses that the source comprises an azimuthally distributed array of axially directed sources T1, T2 (Figs. 3a,7) (Column 9, Lines 40-62).

With regard to claim 21, Leggett discloses sequentially firing the source array in the borehole axial direction according to a pre-selected sequential time delays (Column 15, Lines 42-45).

With regard to claim 22, Leggett discloses that processing the acquired signals further comprises defining an imaging ahead of the drill bit along the axis of the borehole (Column 14, Lines 48-54). Leggett discloses that the sonic measurements are used for look-ahead measurements. Since Leggett is disclosing look-ahead measurement along with the geosteering of a drill bit in a borehole, his disclosure is read as defining imaging ahead of the drill bit along the axis of the borehole.

With regard to claim 24, Leggett discloses that processing the signals further comprises defining time shifts according to a pre-selected imaging direction (Column 12, Lines 35-50). Leggett discloses pre-processing including dynamic corrections. It is known that dynamic corrections are time-shift corrections that align the data along a certain direction (Encyclopedia of Exploration Geophysics).

With regard to claim 25, Leggett discloses that processing the acquired signals further comprises compressing and transmitting the signals to the surface substantially in real time (Column 15, Line 36 to Column 16, Line 22).

With regard to claim 26, Leggett discloses that processing the acquired signals further comprises full waveform processing in the BHA (Column 5, Lines 52-67; Column 15, Lines 36-65).

With regard to claim 27, Leggett discloses that information from the full waveform processing in the BHA is used for a downhole control of a geosteering system (Column 4, Lines 37-48; Column 5, Lines 52-67).

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-5, 10, 18, 20-22, and 25-27 are rejected under 35 U.S.C. 102(e) as being anticipated by Leggett '360.

With regard to claim 1, discloses an acoustic logging apparatus. Leggett discloses a bottom hole assembly 20 (Fig. 1) conveyed on a drilling tubular in a borehole within an earth formation (Column 7, Lines 31-35), said BHA comprising a source array for emitting preselected acoustic signals into the earth formation (Column 11, Lines 39-65). Leggett discloses at least one receiver 199, 182 (Fig. 8) on the BHA for receiving a second acoustic signal produced by interaction of said preselected acoustic signals with the formation (Column 14, Lines 40-60).

With regard to claim 2, Leggett discloses that the source comprises an azimuthally distributed array of axially directed sources and azimuthally distributed arrays of azimuthally directed sources (Fig. 4) (Column 5, Lines 7-11).

With regard to claim 3, Leggett discloses activating the source array according to pre-selected sequential time delays (Column 11, Lines 39-60).

With regard to claim 4, Leggett discloses a source array for emitting the preselected acoustic signals which differs in spectrum or wavemode from the acoustic energy of the rotating drillstring (Column 12, Lines 27-62).

With regard to claim 5, Leggett discloses that the transmitters can be monopole, dipole, or quadrapole (abstract, Column 6, Lines 18-31).

With regard to claim 10, Leggett discloses that one of the receivers 199 receives the second signal 192' that has traversed part of the formation (Fig. 8).

With regard to claim 18, Leggett discloses a system for determining a property of an earth formation using an acoustic logging tool on a bottomhole assembly in a borehole in an earth formation. Leggett discloses at least one source array in an acoustic logging tool for generating preselected acoustic signals into the formation, with the preselected acoustic signals differing in spectrum and/or wave mode from acoustic energy of a rotating drill string (Column 11, Lines 39-65). Leggett discloses that the drillstring rotates at 2Hz (120 rpm) (Column 18), and discloses that the frequency spectrum of the source array is between 500 Hz and 20KHz (Column 12), which is a different spectrum than the energy of the rotating drills. Leggett discloses a plurality of receivers 199 on the logging tool for receiving signals indicative of a parameter of interest (Fig. 8). Leggett discloses acquiring signals at a plurality of depths of the BHA (Columns 5, Line 44 to Column 6, Line 47). Leggett discloses that the measurements are made to geosteering the bit and to update formation models. Therefore, the

measurements are necessarily made at a plurality of depths to be able to continue to steer the bit as the drilling progresses and to update the formation model as the borehole depth progresses. Leggett discloses processing the acquired signals to obtain the parameter of interest (Column 6, Lines 18-48).

With regard to claim 20, Leggett discloses that the source comprises an azimuthally distributed array of axially directed sources and azimuthally distributed arrays of azimuthally directed sources (Fig. 4) (Column 5, Lines 7-11).

With regard to claim 21, Leggett discloses sequentially firing the source array in the borehole axial direction according to a pre-selected sequential time delays (Column 11, Lines 39-60).

With regard to claim 22, Leggett discloses that processing the acquired signals further comprises defining an imaging ahead of the drill bit along the axis of the borehole (Column 5, Lines 7-35).

With regard to claim 25, Leggett discloses that processing the acquired signals further comprises compressing and transmitting the signals to the surface substantially in real time (Column 7, Lines 42-67; Column 14, Lines 1-12).

With regard to claim 26, Leggett discloses that processing the acquired signals further comprises full waveform processing in the BHA (Column 13, Lines 26-30; Column 14, Lines 1-12).

With regard to claim 27, Leggett discloses that information from the full waveform processing in the BHA is used for a downhole control of a geosteering system (Column 14, Lines 25-32).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 5 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Leggett '294 in view of Leggett '360.

With regard to claims 5, 17 Leggett '294 does not disclose that the acoustic transmitters are monopole, dipole, or quadrapole sources. Leggett '360 discloses a similar BHA tool used for acoustic measurements in boreholes. Leggett '360 discloses that the transmitters can be monopole, dipole, or quadrapole (abstract, Column 6, Lines 18-31).

Claims 7-9, 23 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Leggett ('294 or '360) in view of Robbins and further in view of Coates.

With regard to claims 7- 9, 23 and 28, Leggett discloses a plurality of receivers for receiving the second signal. Leggett does not disclose that the receivers comprise a pressure sensor and a motion sensor. Leggett does not disclose that the sensors are a geophone, hydrophone, and accelerometer adjustably located to contact the formation for receiving the second signal. Robbins discloses that geophones and hydrophones are often used in downhole seismic tools in performing look-ahead measurements and

formation measurements (Column 2, Lines 19-67; Column 3, Lines 26-29). It is known that accelerometers and geophones both provide directional information about the seismic waves received, and are interchangeable in many cases. It would have been obvious to modify Leggett to include geophones/accelerometers and hydrophones as taught by Robbins in order to be able to detect pressure waves and to detect seismic waves coming from a certain direction. Coates discloses adjustably locating geophones 23 or accelerometers on a downhole tool so that they can contact the earth formation in order to obtain better seismic coupling and therefore obtain better signals (Column 4, Lines 47-55) (Fig. 2). It would have been obvious to modify the tool of Leggett to include adjustably locating the seismic receivers so that they could contact the formation and therefore achieve better acoustical and mechanical coupling for the seismic signals.

Claims 11 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Leggett '294 or '360 in view of Beresford.

With regards to claims 11 and 19, Leggett discloses a method of obtaining information about a parameter of interest of an earth formation. Leggett discloses using a drill bit 50 on a bottom hole assembly conveyed on a drilling tubular for drilling a borehole in the earth formation (Column 4, Lines 49-65) (Fig. 1). Leggett discloses suspending drilling operations to take seismic measurements. Leggett does not specifically disclose removing the drill bit from the bottom of the borehole. Beresford discloses taking the drill bit off of the bottom of the borehole before acoustic measurements are made (Column 4, Lines 25-39). It would have been obvious to

modify Leggett to include lifting the drill bit off of the bottom before performing the acoustical measurements as disclosed by Beresford in order to acoustically separate the sources and receivers in the BHA from the drill bit and the bottom of the borehole.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Rodney, who discloses a BHA with sources and receivers.

Gill, who discloses a downhole tool with sources and receivers.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Scott A Hughes whose telephone number is 703-305-0430. The examiner can normally be reached on 8:30 am - 5:00 pm. The examiner is moving offices as of April 5th, and can be contacted at (571) 272-6983 after that date.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thomas Tarcza can be reached on 703-306-4171. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Art Unit: 3663

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



SAH



THOMAS H. TARCZA
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 3600